**Date\_\_\_\_\_\_\_\_\_ Time 7:20 Subject Plant Cell Transport Lab Grade\_10**

**Pennsylvania/National Standards:**

* Keystone Anchor
  + BIO.A.2.2: Describe and interpret relationships between structure and function at various levels of biochemical organization (i.e. atoms, molecules, and macromolecules)
* PDE SAS
  + S11.A.3.2.3 Describe how relationships represented in models are used to explain scientific or technological concepts (e.g., dimensions of the solar system, life spans, size of atomic particles, topographic maps).
  + S11.A.1.1.5: Analyze or compare the use of both direct and indirect observation as means to study the world and the universe (e.g., behavior of atoms, functions of cells, birth of stars).
  + S11.B.1.1.1: Explain how structure determines function at multiple levels of organization (e.g., chemical, cellular, anatomical).
  + S11.B.1.1.3: Compare and contrast cellular processes (e.g., photosynthesis and respiration, meiosis and mitosis, protein synthesis and DNA replication).
* National Science Education Standards
  + Standard C 1.1: Cells have particular structures that underlie their functions. Every cell is surrounded by a membrane that separates it from the outside world. Inside the cell is a concentrated mixture of thousands of different molecules which form a variety of specialized structures that carry out such cell functions as energy production, transport of molecules, waste disposal, synthesis of new molecules, and the storage of genetic material.

**Essential Understanding(s)/Key Concepts/Skills:**

* Osmosis and diffusion are processes that allow molecules to pass through a selectively permeable membrane
* Osmosis in plant cells is similar to osmosis in animal cells

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| **Instructional Objectives** | **Aligned Assessments** |
| 1. Given a lab activity sheet and required supplies, the student will explain the effects of osmosis on plant cells with 80% accuracy.  2. Given supplies and a lab handout, the student will design an experiment to observe osmosis in plants and test the effects of salt water on plant cells with 80% accuracy. | 1. Lab handout  2. Lab handout |

**Review of Skills/Content:**

The information learned in the previous lessons regarding the cell membrane and passive transport in animal cells may be reviewed before this lesson. Students will need to recall the information they learned about the structure of the cell membrane and its functions as well as osmosis and diffusion.

**Materials:**

* Student lab handouts
* *Elodea* plants
* Microscopes
* Slides
* Cover Slips
* Salt solutions (5%, 10%, 25%)
* Water

**Behavioral Expectations:**

Students will be expected to follow all posted school and classroom rules. Students will be expected to pay attention to the teacher and respect the teacher and classmates at all times. Since the students will be working in groups, they will be expected to actively participate in group work while maintaining focus and staying on-task. Students will also be expected to clean up their lab areas after the activity.

**Methods of Assessment:**

The lesson objectives will be formatively assessed during the lesson through the use of informal questioning. The lab activity sheets will be collected upon completion of the activity and assessed by the teacher.

**General/Specific Accommodations for Students (Diverse/English Language Learners):**

In order to accommodate English language learners and students with special needs, access to classroom aides such as textbooks will be provided so students may look up words they are unfamiliar with. The instruction will be delivered clearly and concisely. Responses to questions may be modeled and extra time may be given to complete assignments. Students will be allowed to work in groups and may be allowed to hand in a single lab sheet for the entire group. The lab handouts and notes will be read aloud to aid students with visual impairments.

**Instructional Sequence:**

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| **Lesson Implementation** | **Anticipated Student Responses** |
| **Introductory Activity (Anticipatory Set):**  The anticipatory set will include a class review of tonicity, including hypertonic, isotonic, and hypotonic solutions. The students will be shown a video from the Khan Academy demonstrating tonicity (<http://youtu.be/VsW6NXZIUCQ>).  The class will then review the daily objectives which will be written on the board. | The students should sit quietly and actively pay attention to the video.  Some students may not pay attention to the video so the teacher will have to scan and orbit the room to help maintain student focus. |
| **Modeling/Demonstration:**  To begin the modeling/demonstration, the teacher will gain the students’ attention by passing out the lab handouts for the day. Since this is an inquiry-based lab, the teacher will limit the modeling/demonstration to reviewing with the students how to prepare a wet-mount slide. The teacher will then show the students all of the supplies they will be able to use throughout their experiment. | During the modeling/demonstration, it is expected that the students will follow the instruction and pay attention to the instructor. Some students may lack attention so it will be important for the instructor to make sure to maintain student focus during this time. |
| **Guided Practice/Feedback:**  The teacher will then describe to the students how they will be using the materials given to them to design their own experiments to test the effects of tonicity on osmosis in plant cells. The students will be divided into groups of 4 and asked to begin to develop their experimental designs/procedures. As the students are deciding how they will demonstrate the effects of tonicity on osmosis in plant cells, the teacher will go to each individual group to review their experimental designs and provide useful feedback on how the students could carry out or improve their procedures. Once the teacher checks each group’s design, the students will be allowed to obtain their materials and begin their experiments. | The students should fully participate in the guided practice and to use the feedback provided by the teacher to guide their learning and help them understand the concepts being taught.  Moving the students into groups could cause some of them to get off-task. The teacher will have to closely monitor the students during this time to ensure a smooth transition.  Some students may not participate with their group in the experimental design, so it will be important to incorporate all students by asking if they agree with their group or assigning each student in each group a specific role. |
| **Independent Practice:**  Once they have gotten teacher approval of their experimental methods and gathered the required supplies, the students will follow the instructions on the handout to test their hypothesis. The students will then answer discussion questions at the end of the lab activity in order to help further their understanding of cellular transport mechanisms. | The students will be expected to participate fully in the activity with the members of their group and to keep the lab area as clean as possible.  Some students may not want to participate in the activity. The teacher will have to make sure all students are participating equally and sharing ideas.  Some students may make a mess of the lab area when doing their lab activity. The teacher will have to supply paper towels for the students to clean up the area when they are done. |
| **Discussion/Essential Questions:**   * How do we test a hypothesis? * What are the effects of tonicity on osmosis in plant cells? * What happens to plant cells in hypertonic environments? Hypotonic? | The students should be able to answer these essential questions by the end of the lesson. |
| **Formative Assessment:**  The formative assessment for this lesson will consist of the students’ answers to informal questioning throughout the lesson as well as their experimental designs on their lab handouts. The information gained from these assessments will allow the teacher to make sure students understand the key concepts being covered in the lesson and adapt future lessons. |  |
| **Closure (Review/Preview):**  To close this lesson, the students will be asked to share the results from their lab along with the experiments they performed to get these results. The teacher will also show them a video of onion cells in hypertonic solution to reinforce what they should have observed (<http://youtu.be/gWkcFU-hHUk>). This will provide the students an opportunity to think about all of the information they learned throughout the lesson and put it all together. | The students should participate in the discussion and should provide their own unique input. They should also think critically about the information they learned over the course of the unit so far. Some students may not participate, so the teacher should guide them into discussion by asking if they agree or disagree with other students. |
| **Extension Activities:**  The extension activity that will be used if the lesson is finished before the end of the period will consist of asking the students to look over the review pages in their textbooks regarding the concepts that were taught during this lesson and the unit up to this point | The students should maintain focus while completing this activity, but some may lose focus since the period will be almost over. The teacher will need to help maintain student focus. |

**Correction Procedures/Potential Areas of Difficulty:**

Some students may have difficulty with creating an experiment on their own in this inquiry-based activity. The teacher will have to make sure each student gets a chance to ask questions and receive feedback on their experimental design before starting their experiments. Other than that, the students should have little difficulty with this lesson as it is mostly review of what they have previously learned.

**Summative Assessment:**

**Assessment Items**

* Plant Cell Osmosis Lab handout

**Answers and Scoring Criteria**

Plant Cell Osmosis Lab Rubric:

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|  | **Excellent (4 points)** | **Good (3 points)** | **Adequate (2 points)** | **Needs Work (1 point)** | **Incomplete** |
| **Introduction** | 1. Includes the question to be answered by the lab.  2. States hypothesis that is based on research and/or sound reasoning.  3. Title is relevant | Two of the “excellent” conditions are met. | One of the “excellent” conditions are met. | Introduction is present but no exemplary conditions are met | Not attempted |
| **Methods** | Description or step-by-step progress is included, could be repeated by another scientist | Description is included but some steps are vague or unclear | The description gives generalities, enough for reader to understand how the experiment was conducted. | Would be difficult to repeat, reader must guess at how the data was gathered or the experiment conducted. | Not attempted |
| **Data and Analysis** | Results and data are clearly recorded, organized so it is easy for the reader to see trends. All appropriate labels are included. | Results are clear and labeled, trends are not obvious or there are minor errors in organization. | Results are unclear, missing labels, trends are not obvious, disorganized, there is enough data to show the experiment was conducted | Results are disorganized or poorly recorded, do not make sense, not enough data was taken to justify results | Not attempted |
| **Conclusions** | 1. Summarizes data used to draw conclusions  2. Conclusions follow data (not wild guesses or leaps of logic)  3. Discusses applications or real world connections  4. Hypothesis is rejected or accepted based on data. | 3 of 4 of the “excellent” conditions are met. | 2 of 4 of the “excellent” conditions are met. | 1 of 4 of the “excellent” conditions are met. | Not attempted |
| **Format and Lab Protocols** | Lab report submitted as directed and on time. Directions are followed, stations were cleaned. All safety protocols were followed. | Most of the “excellent” conditions were met with possible minor errors in format or procedures. | Some of the “excellent” conditions met, directions were not explicitly followed, lab stations may have been left unclean or group not practicing good safety. | Student did not follow directions, practiced unsafe procedures, goofed around in the lab, left a mess or equipment lost. |  |
|  | **Total (out of 20 points):** | | | | |

**Modified Assessment Items for Students with Disabilities and English Language Learners:**

* Plant Cell Osmosis Lab handout – Students may be allowed to turn in group report, handwrite report, or present result orally at teacher discretion.

**Reflections:**

**Sources:**

Lab Report Rubric. (n.d.). *The Biology Corner*. Retrieved October 18, 2012, from http://www.biologycorner.com/worksheets/labreport\_rubric.html